Flight Test Instrumentation Package for the L-29 Delfin Turbojet

For the
Quarterly Review of the NASA/FAA Joint University Program for Air Transportation Research
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Purpose

- Hardware/software sensor testbed
- Software INS/GPS integration
- Noise versus dynamic tracking error trade off
- Synthetic aperture radar
- Aircraft system id/flight control design educational tool

Flight Test Vehicle

- **L - 29 Delfin**
- **High Altitude 11 Km**
- **High Speed 354 knots**
- **Fully Aerobatic**

Flight Specs Taken From http://aeroweb.brooklyn.cuny.edu/specs/aero/l-29.htm

Delphin Equipment

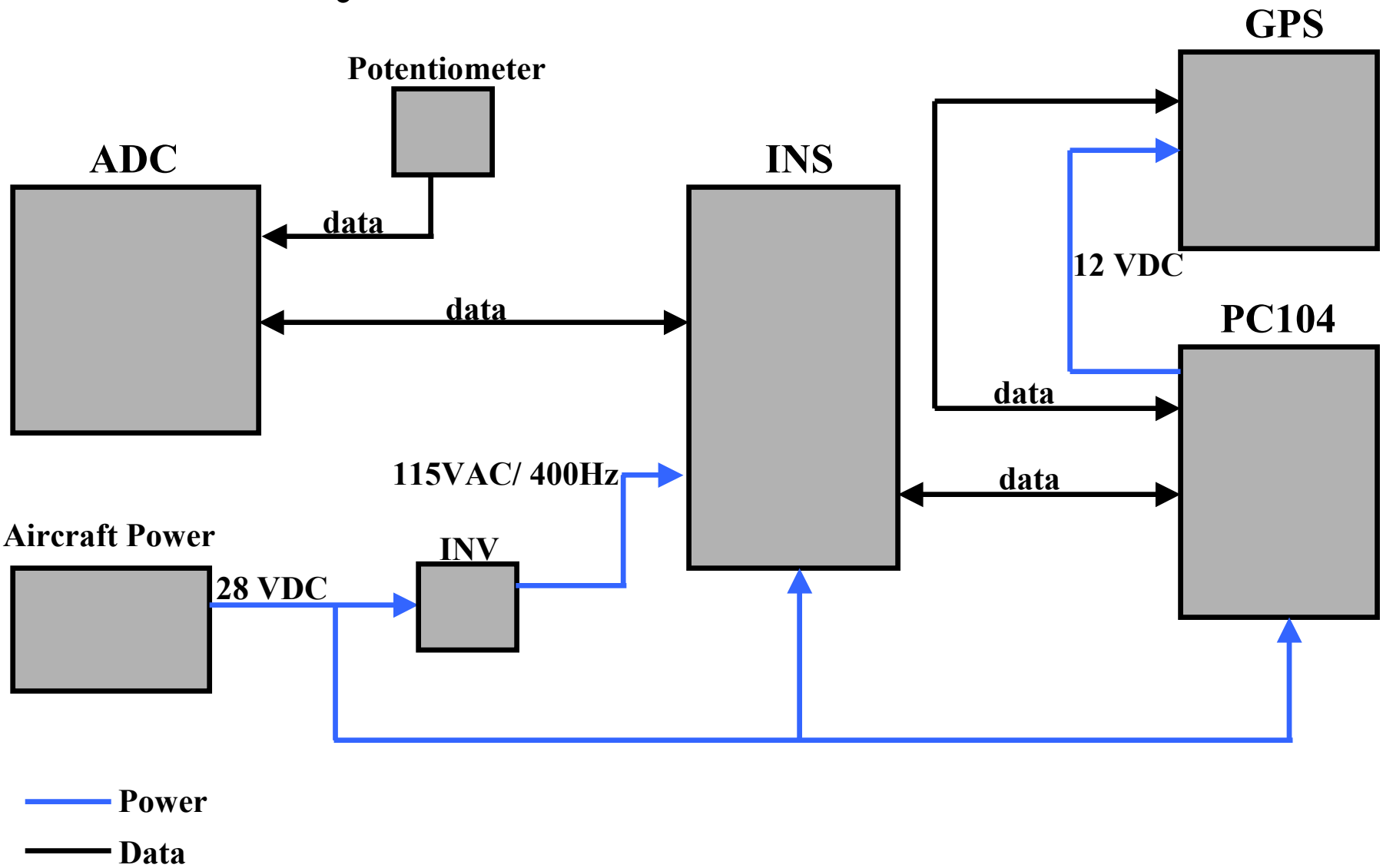
- Navigation Grade INS
- Industrial Keyboard
- Shock-hardened Computer
- Industrial Flat Panel Display
- NovAtel GPS Receiver
- Tactical Grade IMU

*The IMU will be integrated into the system at a later date

Project Development

- Initial equipment installation is complete
- GPS and INS data collected simultaneously in real time
- In process of supplying INS unit with 28VDC

System Block Schematic



INS Data Collection System Power Specifications

Unit	Voltage	Current	Power
INS	115VAC/400HZ	2A	230W
INS (backup)	28VDC	10A	280W
INS Cooling Fan	28VDC		
PC104	8-32VDC	11A Max	85W Max
ADC	28VDC	350mA	10W Max
Monitor	12VDC	3.5A	42W
GPS	6-18VDC		2.8W(3.3W Max)

PC104 Power Distribution

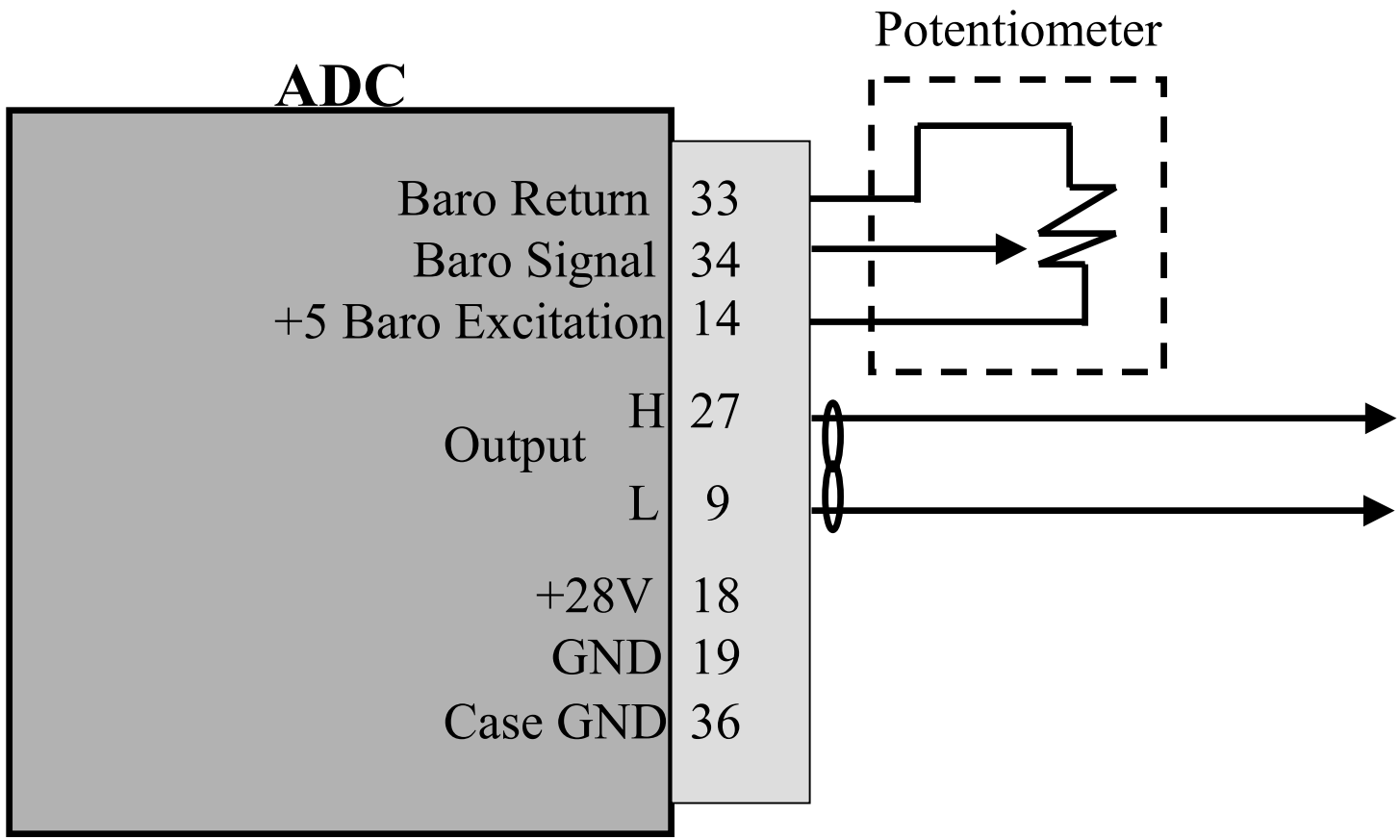
Component	Voltage	Current	Power
CPU Module	5VDC	2A(1.5A Max)	10W
CM102 Floppy	5VDC	125mA	625mW
CMT107 Hard-drive	5VDC	1A max(fused)	5W
Network Card	5VDC	200mA	1W
Keyboard	5VDC	200mA	1W
GPS	+12VDC	235mA	2.8W

PC104 Power Availability

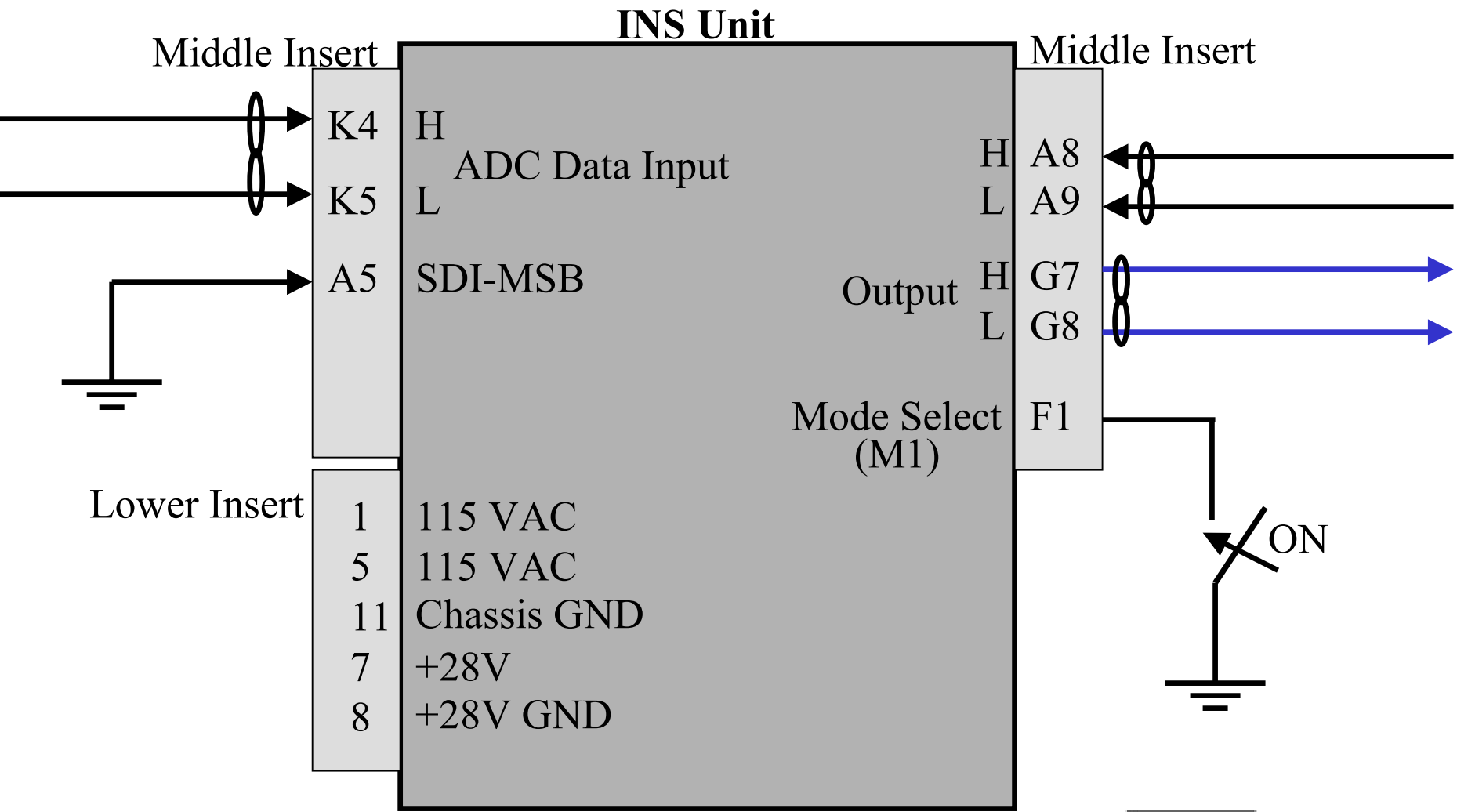
Voltage	Current	Power
5VDC	12A	60W
+12VDC	2A	24W
-12VDC	500mA	6W

Maximum Power Output From PC104: 75W

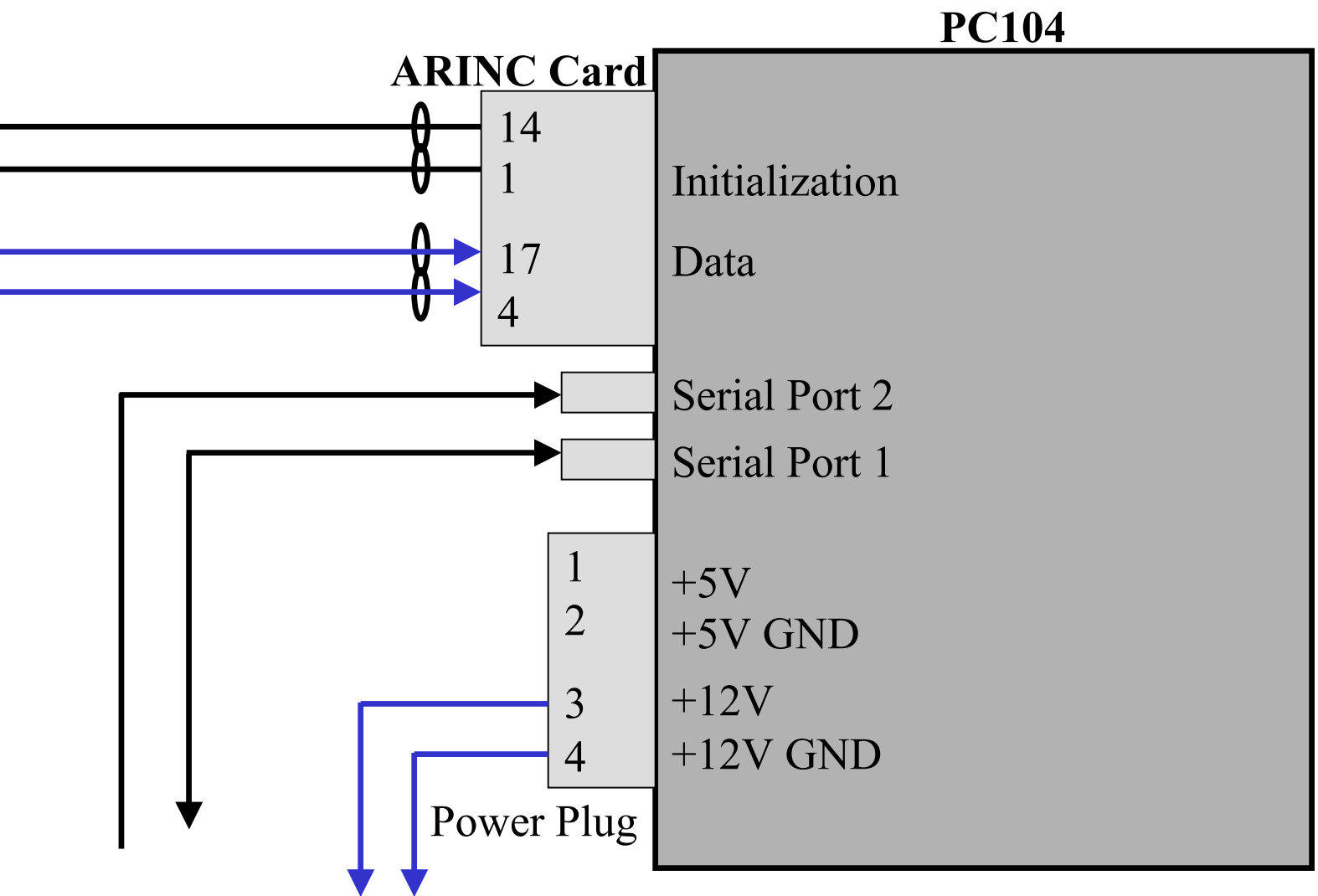
System Schematic



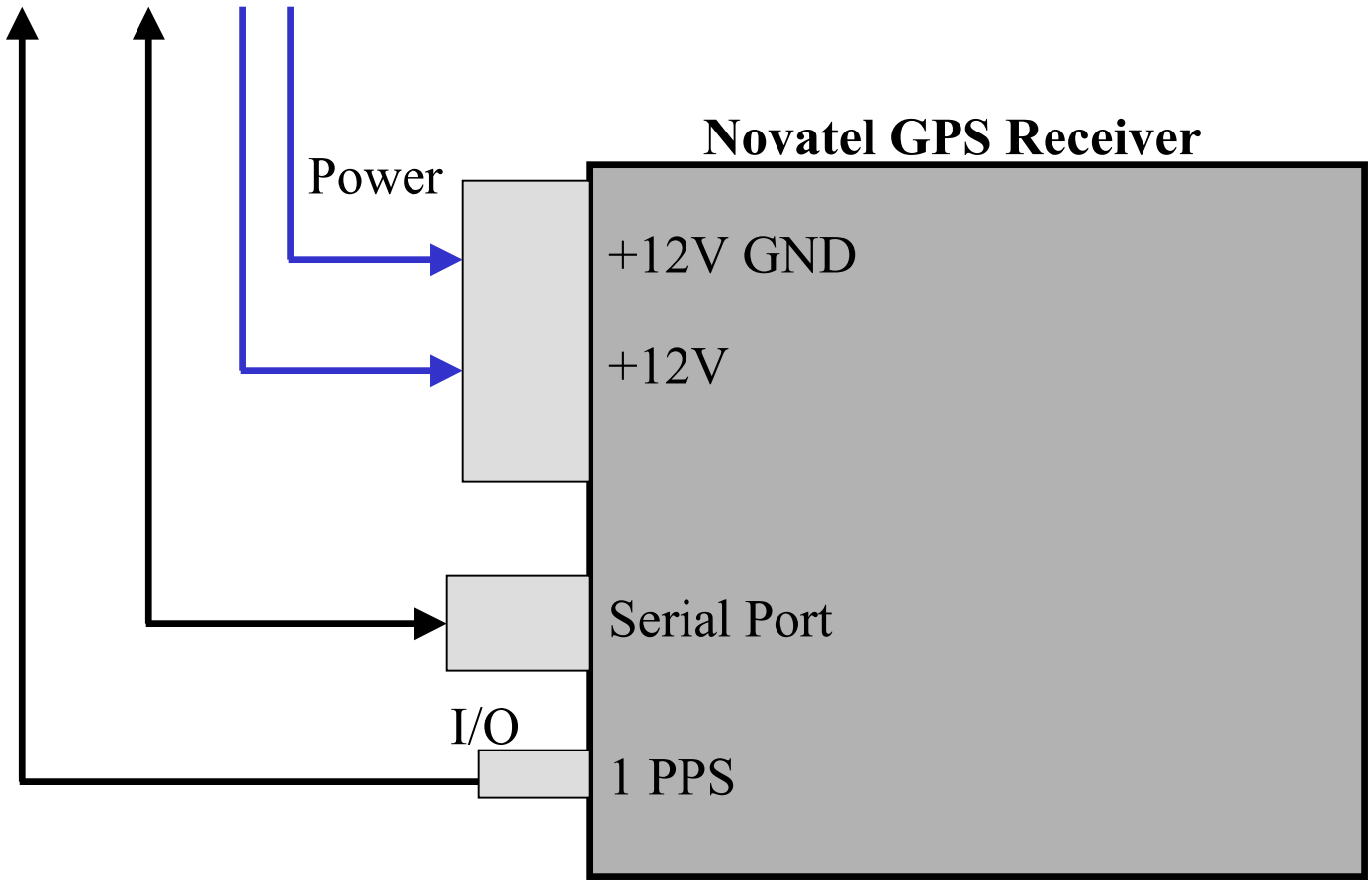
System Schematic Continued



System Schematic Continued

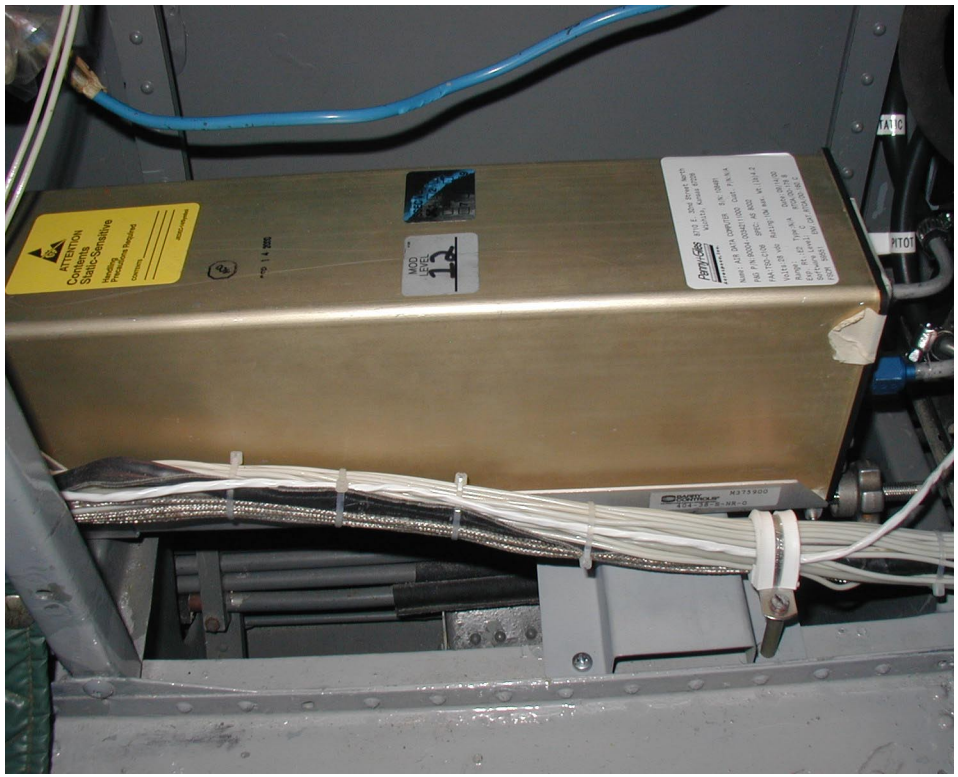


System Schematic Continued

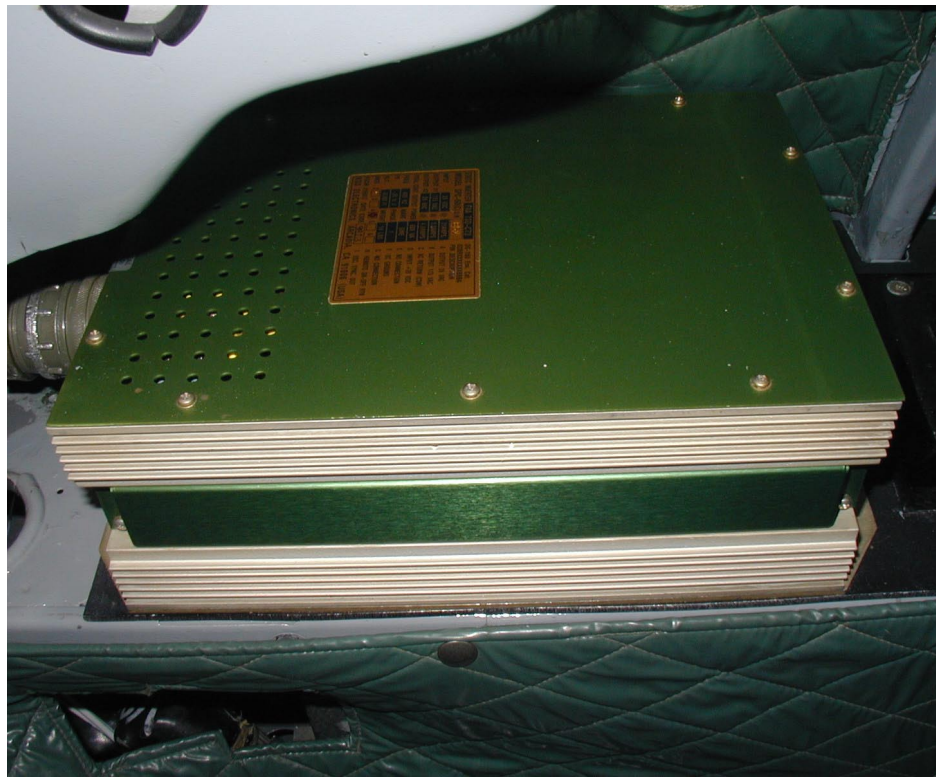


Installed Equipment

ADC



Inverter

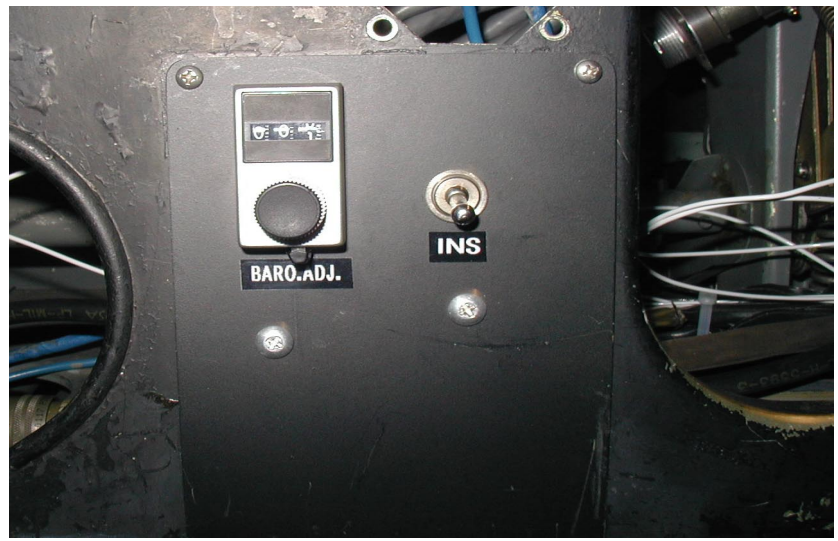



50 100
150
BAR ADJ.
SEAT

Installed Equipment Continued

Industrial Keyboard

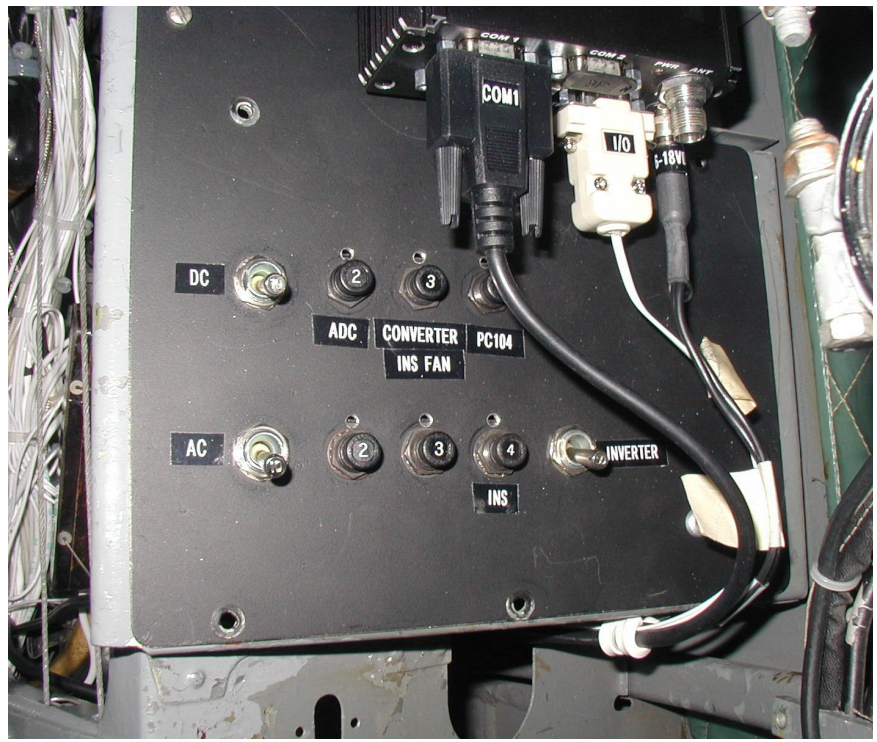
INS On Switch



Installed Equipment Continued

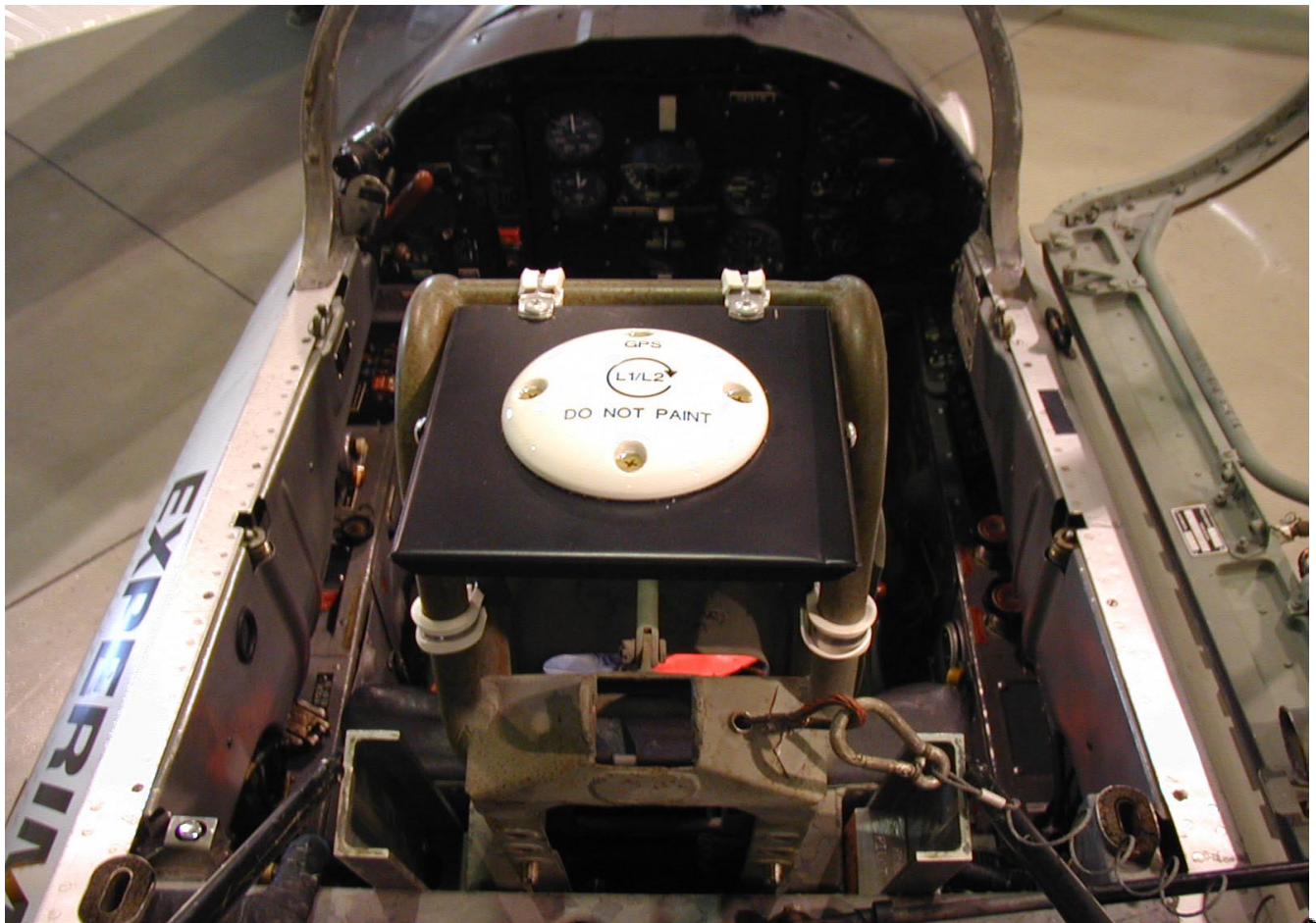
Novatel GPS Receiver

Control Switches

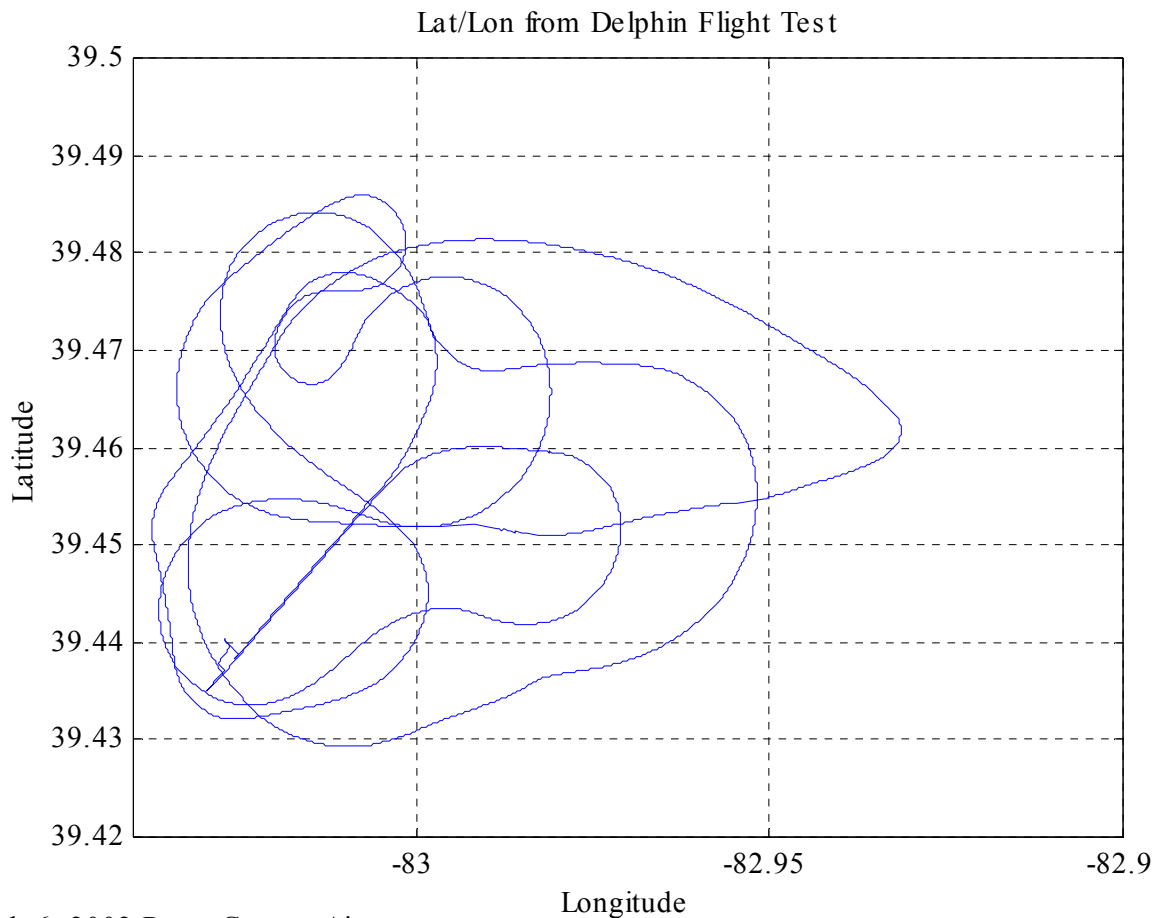


Installed Equipment Continued

GPS Antenna



GPS Data



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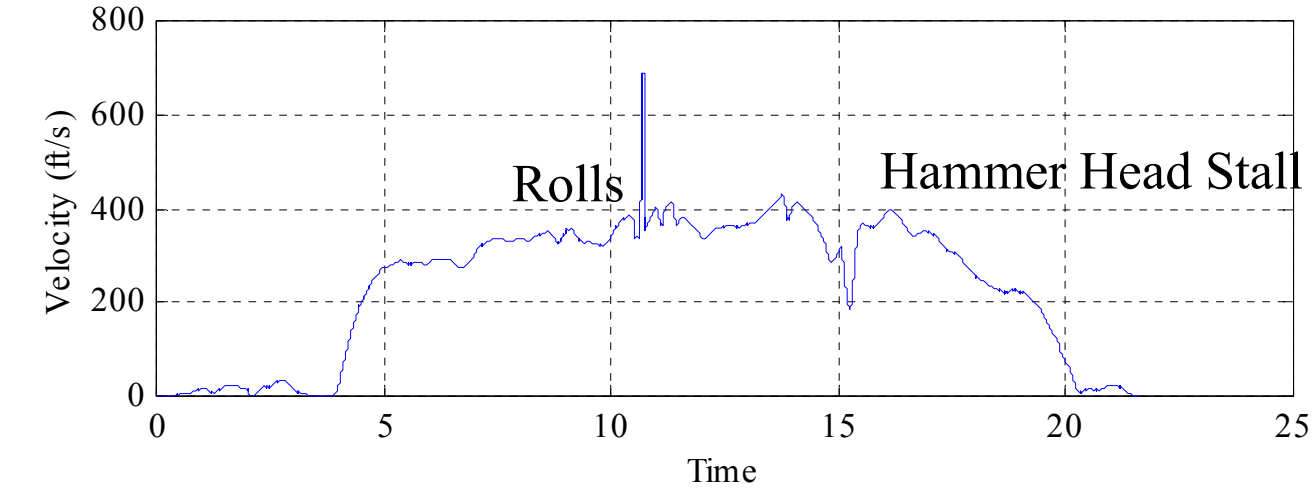
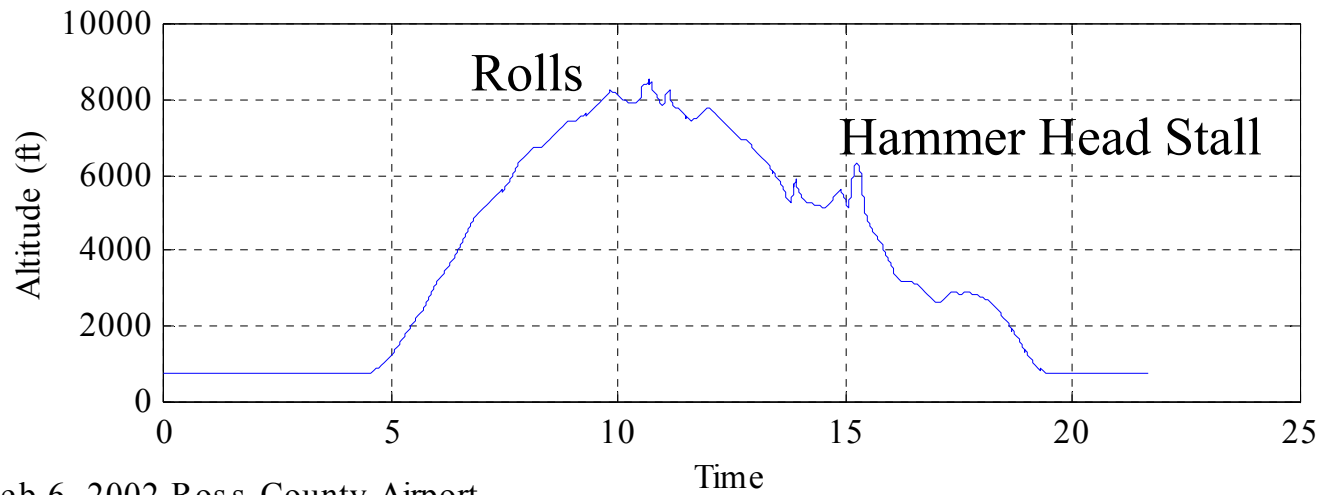
GPS Data Continued





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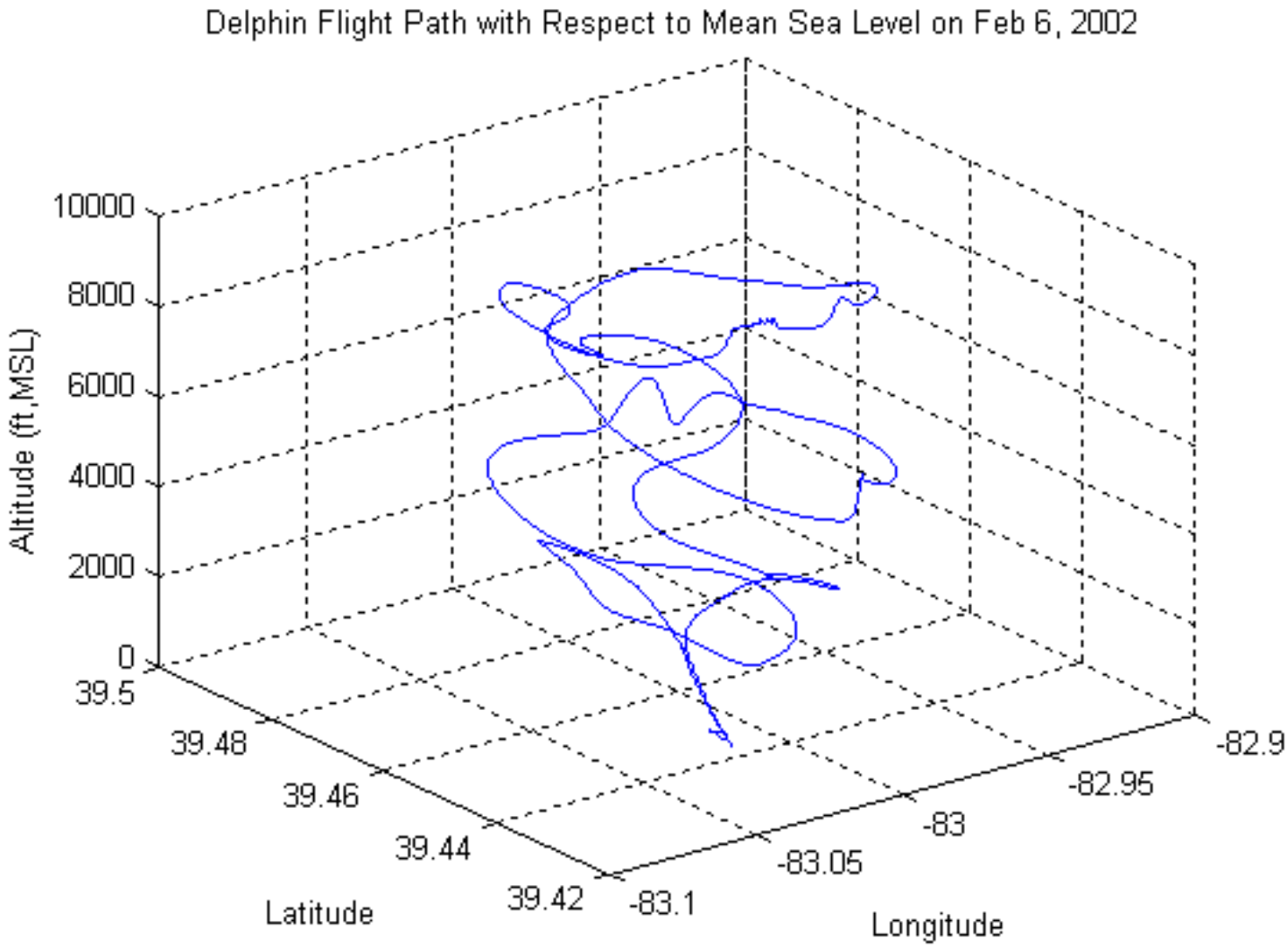
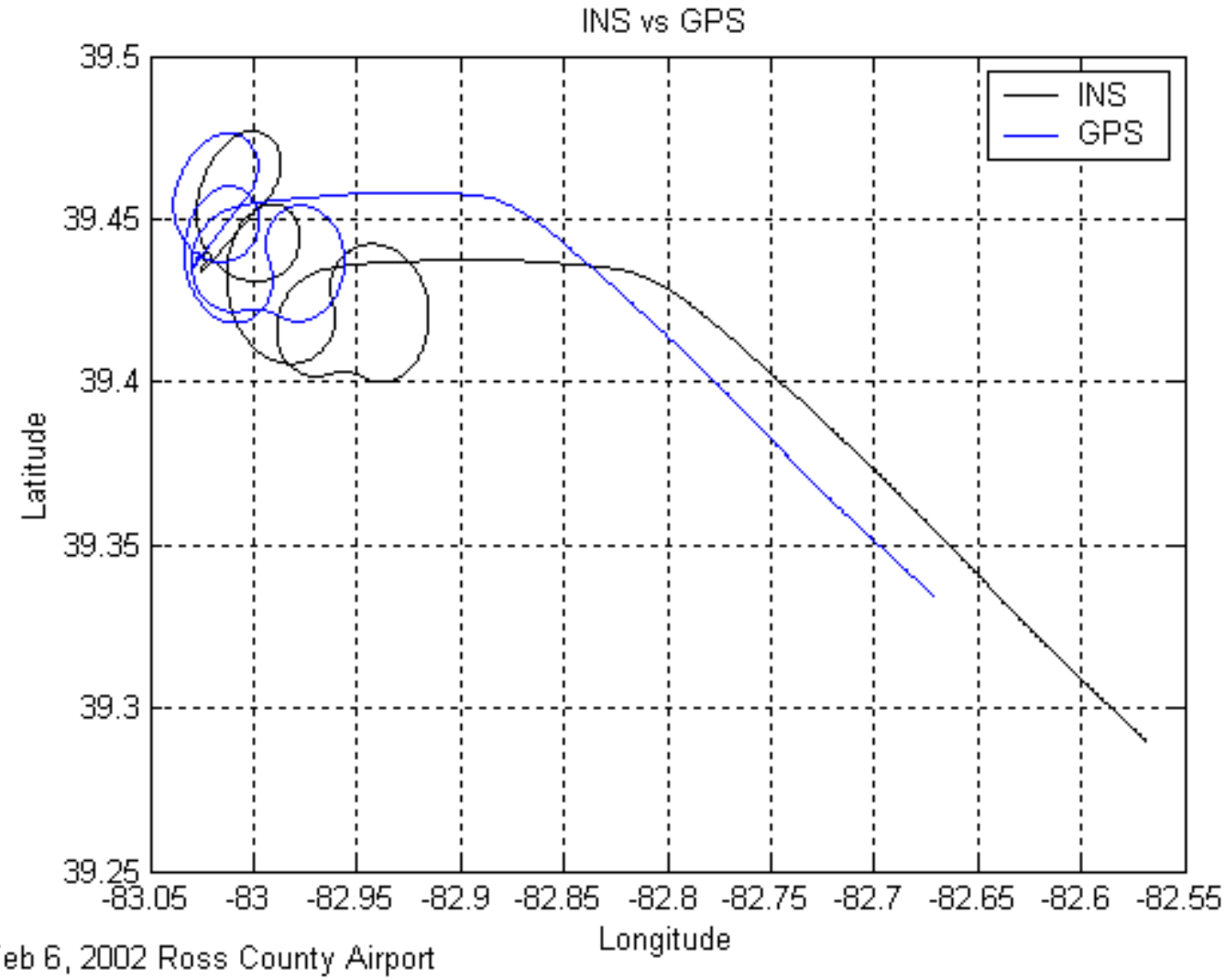
GPS Data Continued



INS

- INS Data has been collected on one flight test
- Latitude and Longitude was post processed from the collected data
- Initially, data seemed to be fine

GPS and INS Data



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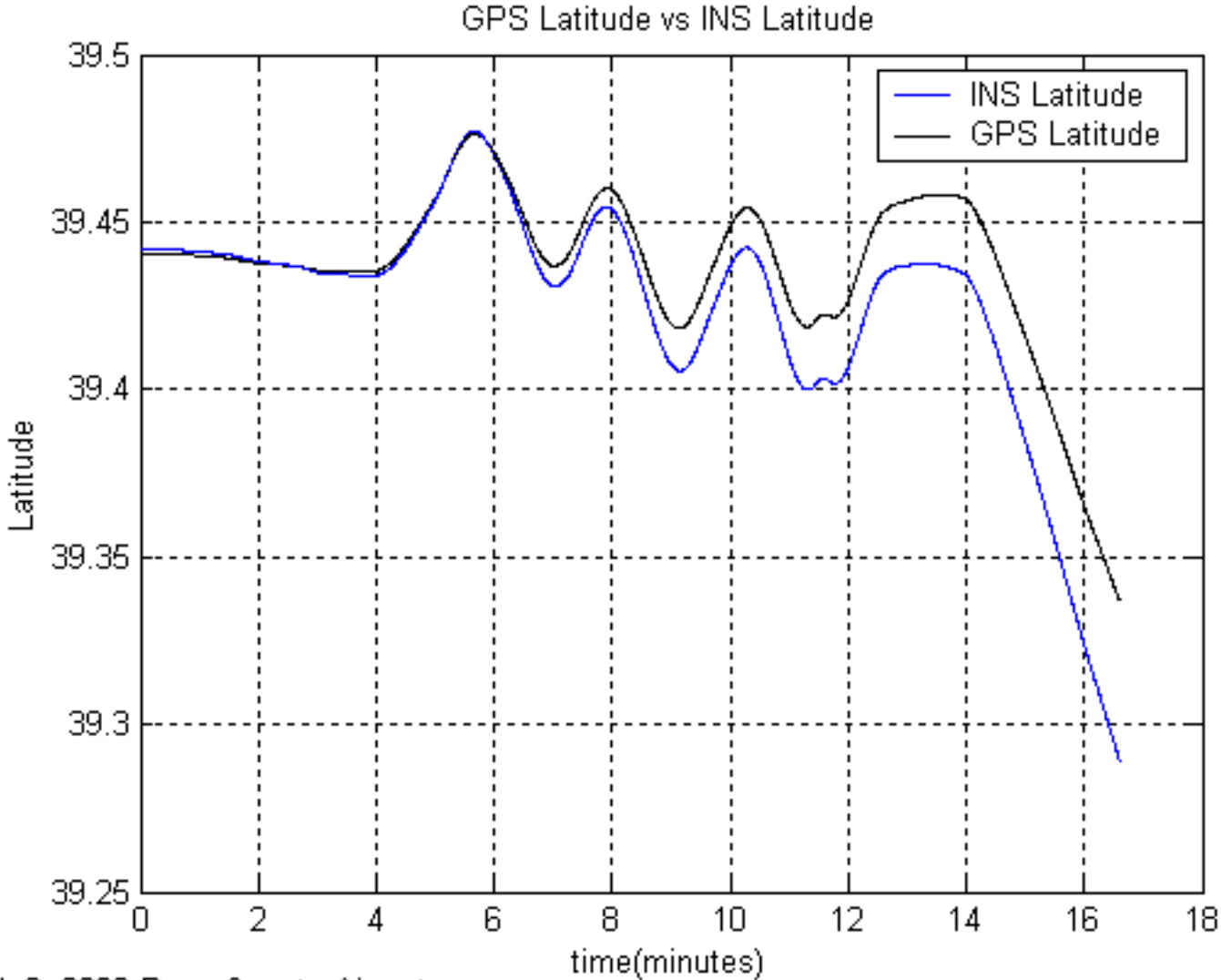
GPS and INS Data Continued



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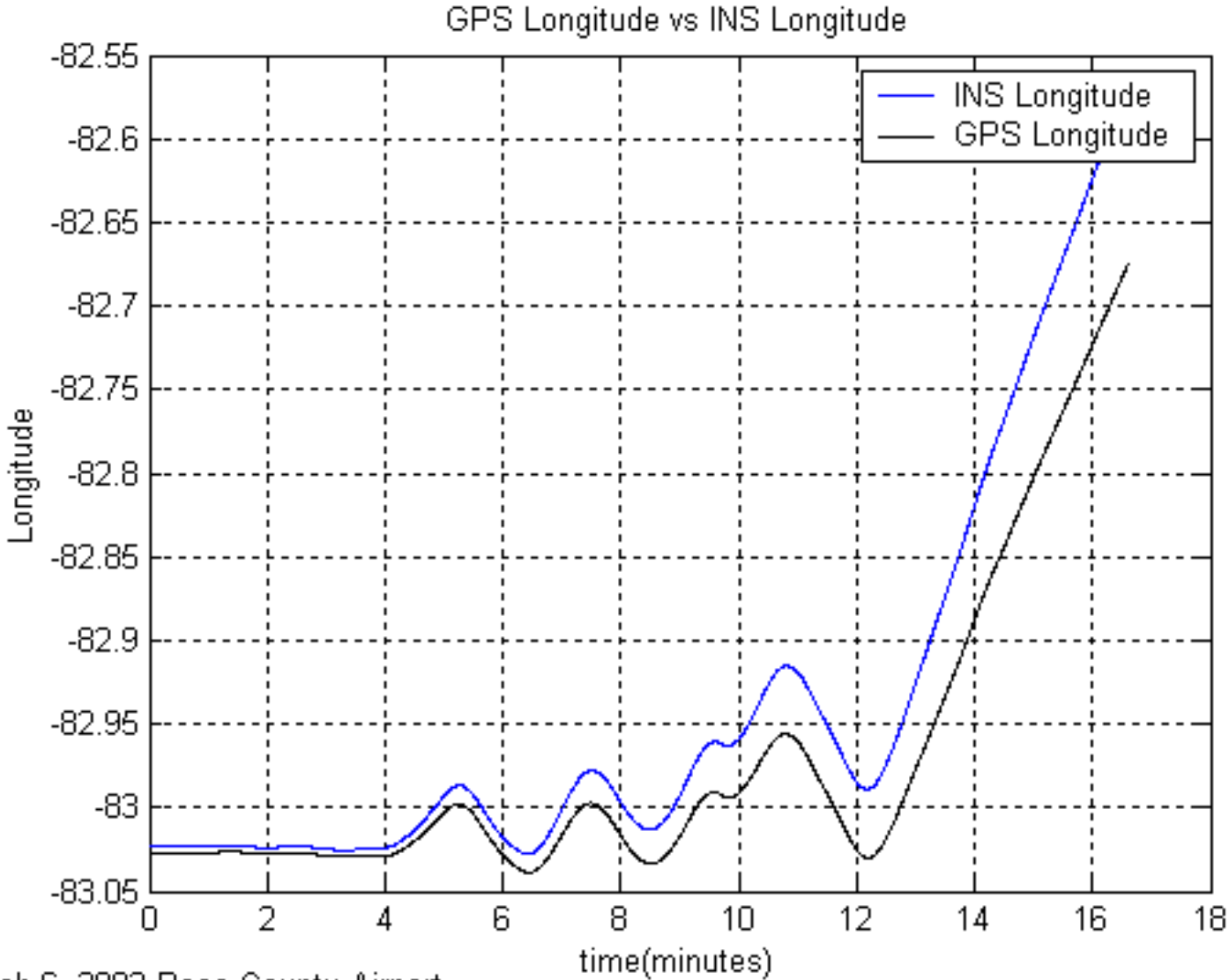
GPS and INS Data Continued



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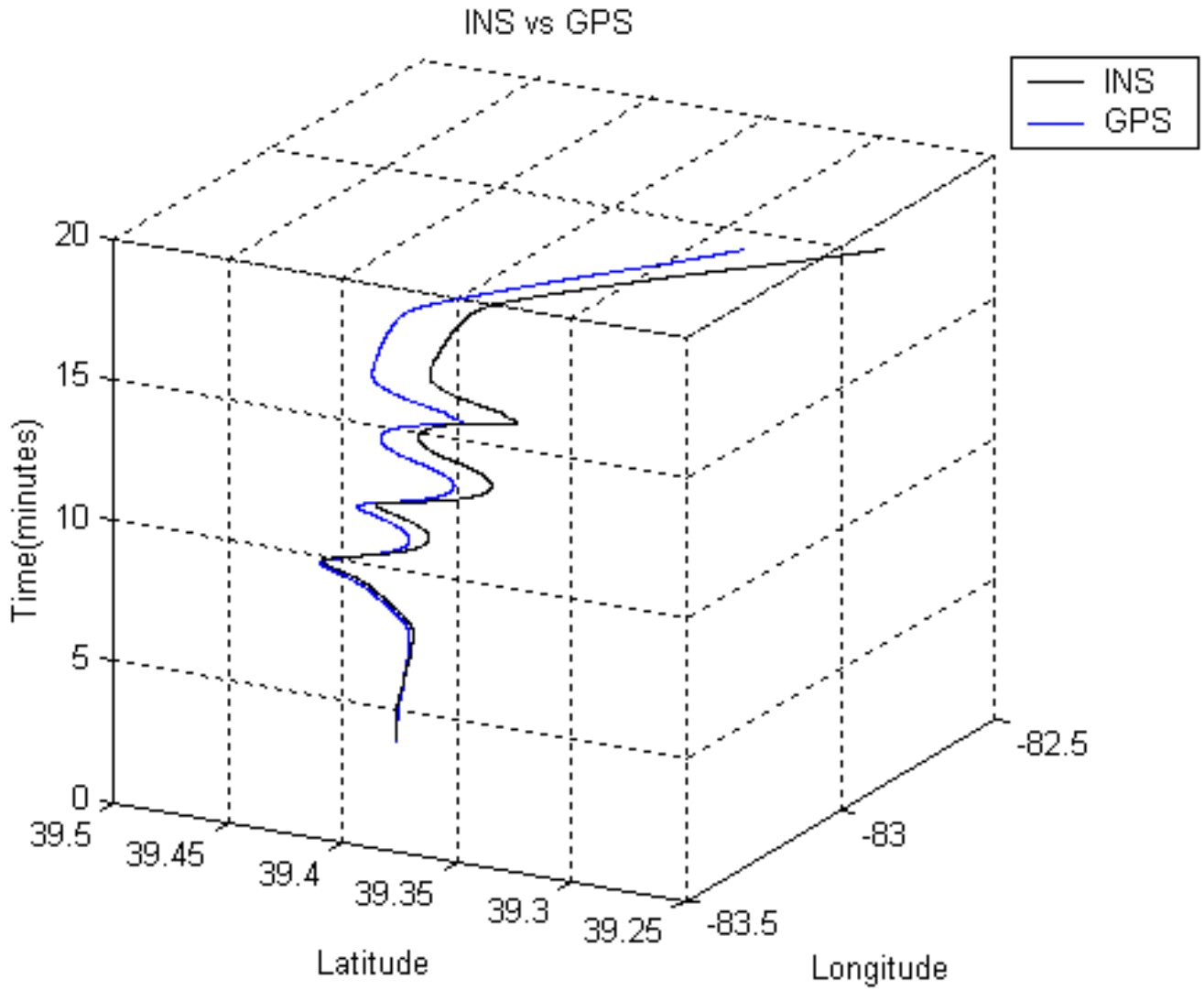
GPS and INS Data Continued



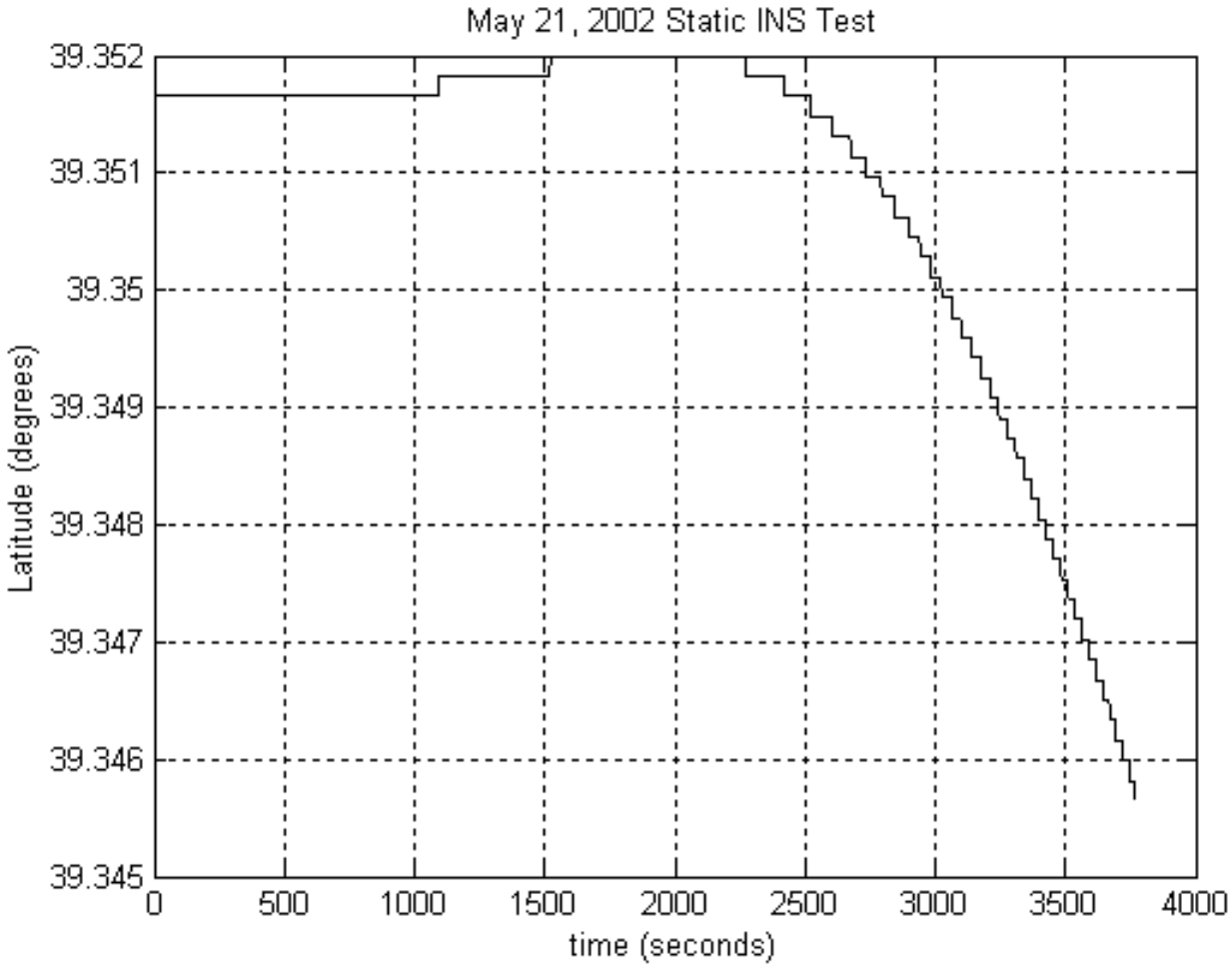
Analysis

- GPS and INS drift apart as expected
- 6 Mile difference by end of flight test
- Error much too large for INS unit

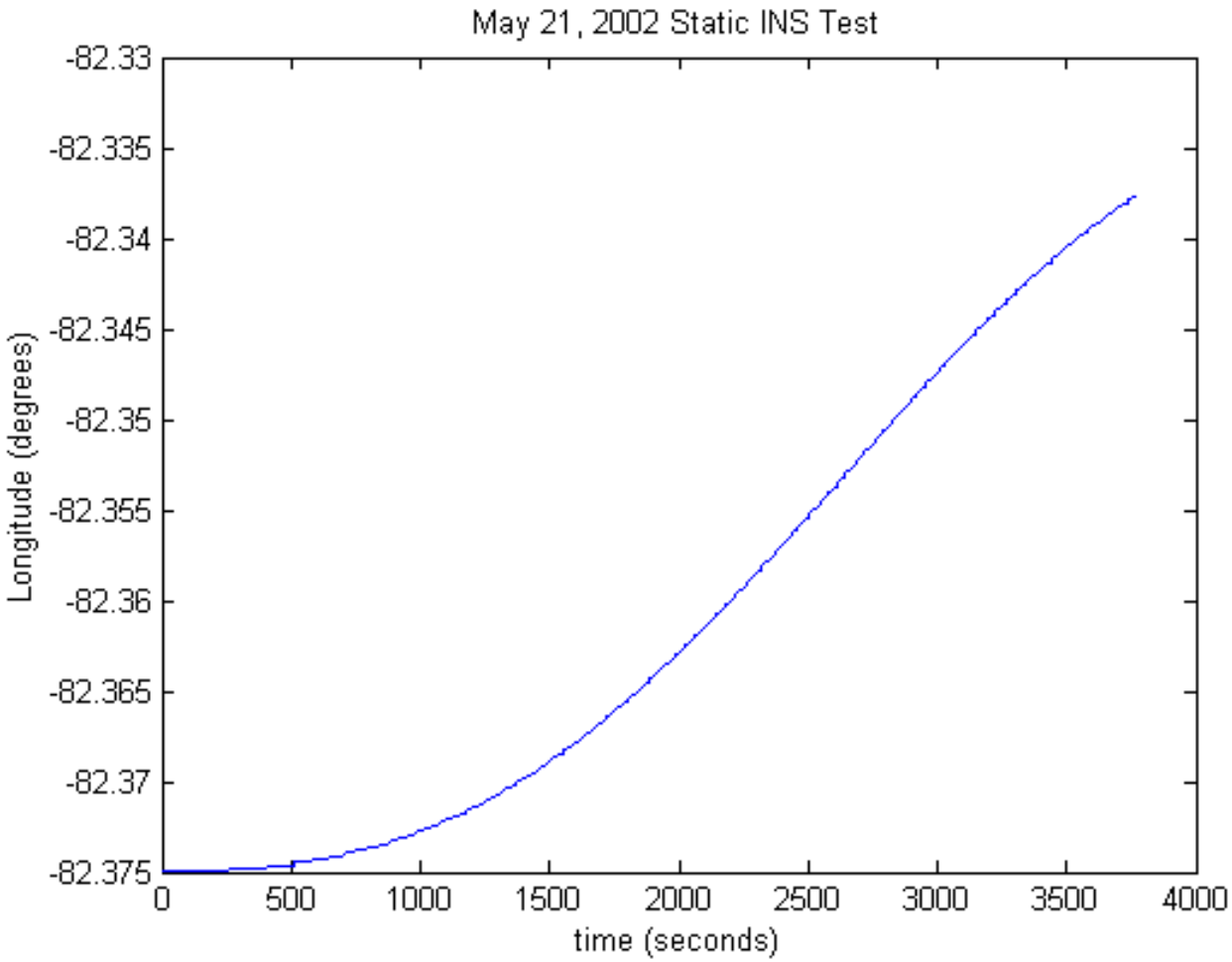
Analysis Continued

- A problem with the INS installation was discovered and corrected
- INS can send unreliable data if not initialized properly
- Error was masked from view

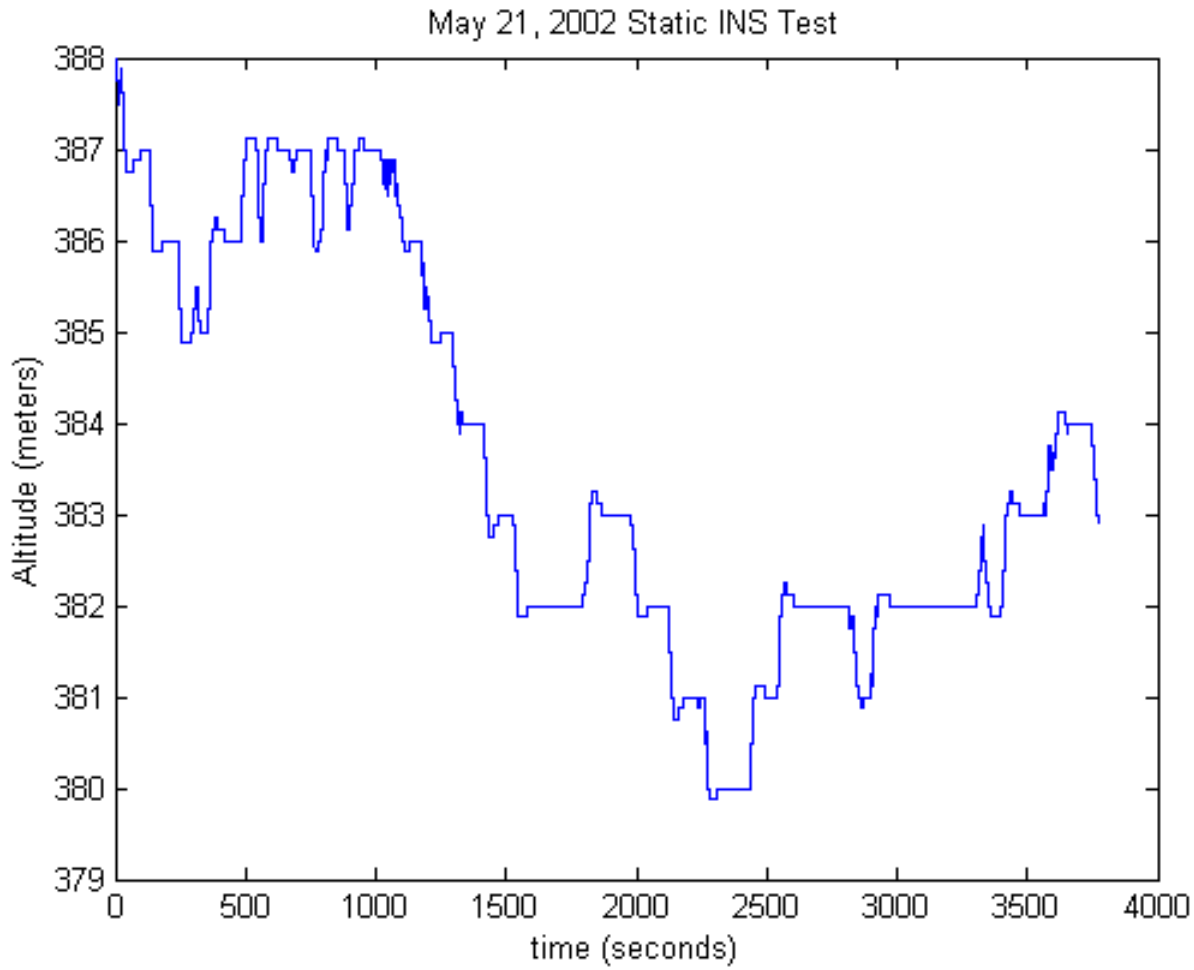
INS Static Test



INS Static Test



INS Static Test



Conclusion

- INS and GPS data collection is ongoing
- INS data collection software is still being refined and updated
- More flight testing is needed to determine if the INS problem is really fixed

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